Lyman α imagings of comet 67P/Churyumov-Gerasimenko by the PROCYON/LAICA

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Water production rate of a comet is one of the fundamental parameters to understand not only the cometary activity when a comet approaches the Sun within 2.5 AU but also the formation processes of molecules that were incorporated into comets formed in the early Solar System.
Comet 67P/Churyumov-Gerasimenko (hereafter 67P/C-G) is a Jupiter-family comet with an orbital period of ~6.5 years. Because the comet during the apparition in 2015 was a target of ESA's Rosetta mission, comet 67P/C-G was the most interesting comet. By the Rosetta spacecraft along with Philae lander, various kinds of observations of the comet were carried out from close to the surface of the nucleus for more than two years including its perihelion passage on 2015 August 13. However, observation of the entire coma was difficult by the Rosetta spacecraft because the spacecraft was located in the cometary coma. An estimated water production rate strongly depends on physical models of the coma, notably depend on the asymmetry of the coma and nucleus of the comet.
To derive an absolute water production rate of the comet, wide-field imaging observations of the hydrogen Lyman α emission in comet 67P/C-G were carried out by the Lyman Alpha Imaging CAmera (LAICA) on board the 50 kg-class micro spacecraft, the PROCYON on UT 2015 September 7.40, 12.37, and 13.17. Our observational dates correspond to 25, 30, 31 days after the perihelion passage of the comet. We derived the water production rates of the comet from Lyman α fluxes of the comet by using a two-dimensional axi-symmetric Direct Simulation Monte-Carlo (DSMC) model of atomic hydrogen coma. Derived water production rates, $(1.46 \pm 0.47) \times 10^{28}$, $(1.24 \pm 0.40) \times 10^{28}$, and $(1.30 \pm 0.42) \times 10^{28}$ moleules s-1 on September 7.40, 12.37, 13.17, respectively, are comparable to the water production rates estimated from *in situ* measurements by the Rosetta instruments based on the coma model of the comet. We discuss about and secular change of water production rate, and also suggest an importance of observations with small satellites.

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